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ABSTRACT

Organizational systematics were applied to a classification scheme for postsecondary institutions using a combined phyletic-phenetic approach. Nine characteristics of organizational structure were operationalized for the college setting: institutional autonomy, centralized decision making, functional specialization, effective participation, formalized procedures, and four measures of organizational configuration, including hierarchy of control and division of labor. A second set of characteristics consisted of 23 institutional attributes that are commonly used to describe the diversity of colleges, including such items as control and faculty and student size. Data were collected from 150 colleges. Factor analytic techniques were employed, and 16 taxonomic clusters were identified as representing optimally homogeneous groups of institutions. The phyletic approach based on decision-making authority and functional responsibilities developed a classification scheme, composed of four institutional types: bureaucratic, bureaucratic/academic, academic/bureaucratic, and academic. A numerical phenetic analysis identified four factors: decision-making authority, functional differentiation, administrative configuration, and operational procedures. A questionnaire is appended. (SW)

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Organizational Systematics: Toward a Classification Scheme for Postsecondary Institutions

by

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This paper was presented at the Annual Meeting of the Association for the Study of Higher Education held at the Conrad Hilton Hotel in Chicago, Illinois, March 12-14, 1984. This paper was reviewed by ASHE and was judged to be of high quality and of interest to others concerned with the research of higher education. It has therefore been selected to be included in the ERIC collection of ASHE conference papers.

Organizational Systematics: Toward a Classification Scheme for Postsecondary Institutions

INTRODUCTION

Organizational Systematics

Over the years biologists have developed a classification system which allows them to not only classify plants and animals but also provides the scientific basis for studying structure, function and process in the biological realm. In a book entitled Organizational Systematics, McKelvey borrows those techniques and principles used by biologists and applies them to the study of organizations. His basic premise is that like other organisms, organizations have evolved from common origins and developed adaptive characteristics based on internal organizational and environmental demands. In order to understand what McKelvey terms the functional approach to the study of organizations, that is, studies which attempt "to understand the behavior of organizations by analyzing the structure, function and process of various components," (McKelvey, 1982, p. 14), one must first develop a classification scheme as a basis for analyzing why and how different organizations, like biological organisms, may respond differently to similar environmental or internal factors. In other words, instead of studying apples and oranges, a classification scheme would allow the application of functional theories to similar organizations ("homogenous populations").

In defining Organizational Systematics, McKelvey states:

> Put simply, organizational systematics is the science of organizational populations, the development of taxinomic theory, the recognition and classification of important differences, and the discovery of how and why the differences came about....[It] requires a way of thinking totally at odds with orthodox views of "good" organizational sociology or organization theory....(McKelvey, 1982, p. 2).

He notes further that organizational systematics will aid scientific understanding, explanation, and prediction. The use of systematics will result in the use of homogenous populations which will enhance replication and prediction methods used in scientific inquiry.

Two approaches used in biology to develop classification schemes are the phyletic approach (McKelvey, 1982, p. 29) and the phenetic approach (McKelvey, 1982, p. 42). The phyletic approach to classification consists of tracing out the origins and evolution of the organism. In phyletics the history of organizations and their various adaptations to the environment become important to the development of a classification scheme. According to Mayr (1969, p. 15), there are three stages in phyletic classification. First, "alpha taxonomy," involves a new species and its arrangement in larger groupings. The second state, "beta taxonomy," involves a more specific definition of the relationship of the species and their relationship to higher

categories in the classification scheme. The final stage, "gamma taxonomy," focuses on variations within the species, their evolution and an explanation of why various adaptive characteristics developed (McKelvey, 1982, p. 31).

The numerical phenetic approach rejected the evolutionary approach because it was based on a priori theory. In the phenetic approach, if you study enough characteristics empirically, the natural groupings of organisms will emerge. To avoid a priori theory each characterictic is given equal weight. Numerical values are assigned to characteristics, and correlations between organisms will result in the emergence of a natural classification scheme (McKelvey, 1982, p. 43).

While there are many arguments for or against either approach, Mckelvey (1982) advocates a combined phyletic-phenetic approach. He notes that each method can be mutually beneficial to the other. He notes that this combined approach will result in better science because:

> Phyletic classification is inductive in the sense that it starts from observations of naturally evolving phenomena and through processes that are at once subjective, insightful, creative and based on guesses, possibilities, and so forth, develops a broad theoretical classification from the observation of particular objects and events in the past.... [On the other hand], [n]umerical phenetic classification is deductive in the sense that it starts from already existing, hypothesized classes and through the use of sector

> definition, random sampling, careful observation and measurement, and the objective use of multivariate statistical methods, tests the truth of the hypothsized population (McKelvey, 1982, p. 63).

While either of these methods is powerful in its own right, together they offset each of their weaknesses.

This paper will apply organizational systematics to a classification scheme for the organizational species postsecondary educational institutions using the combined phyletic-phenetic approach. The phyletic approach will concentrate at the gamma taxonomy state. First, a proposed general classification scheme will be presented. Second, using the phyletic approach, a gamma taxonomy focusing on postsecondary institutions will discuss divergent characteristics at the species level. Third, a numerical taxonomic approach will be applied to the species. Finally conclusions and implications of the combined approach will be discussed with emphasis on further research.

THE BROAD CLASSIFICATION SCHEME

While this study is focusing on the species postsecondary institutions, its relationship to higher categories in the classification scheme is important.

This section is not an attempt to justify the classification scheme presented below, but rather an attempt to help the reader conceptualize the relationship of postsecondary educational institutions to higher categories in a classification scheme. The nomenclature used in the scheme presented in Figure 1 is

simply the author's subjective classification scheme (see also McKelvey, 1982, pp. 259, 262 for other examples).

While this classification scheme is a preliminary approach, it gives the reader one basis upon which to relate the species postsecondary institutions to the higher categories in the scheme.

THE PHYLETIC CLASSIFICATION SCHEME

Since the establishment of Harvard in 1950, postsecondary institutions have evolved and adapted to the demands and needs of the environment. Brubacher and Rudy (1976), Veysey (1969) and Henry (1975), among others, note this adaptation. The existence of universities, liberal arts colleges, normal schools, and community and technical colleges certainly point to adaptation in meeting societal needs. Various classification schemes have been proposed for postsecondary institutions with the most widely accepted scheme being the Carnegie Classification (1976). This classification is based on the number and types of degrees awarded by institutions and federal money received for research. While such an approach may be adequate, this classificaton scheme can be refined by looking at the current literature on organization theory in postsecondary education and expanding the characteristics used to arrive at a phyletic classification scheme.

Organization Theory of Higher Education

The evoluation of organization theory in higher education has been an interesting one. Corson (1960) analyzed the

decision-making process in higher education. He found a "dualism of organizations" in higher education: the academic sphere and the administrative sphere. The academic sphere was the faculty governance structure while the administrative sphere was the president and the board. This model dealt solely with the existence of the two decision-making spheres but said nothing about the pull or overlap of responsibilities between the two. This oversight notwithstanding, his contribution to organizational theory would later prove to be substantial.

John D. Millett (1962) advocated the academic community model as a way of describing organizations in higher education. While perhaps the community of scholars did exist at one time, this model did not in any way come close to describing the variety of institutional types existing in higher education. In his latest work, Millett (1978) acknowledged the weakness of using the collegial model as a viable model for describing higher education today and cited several more acceptable models for describing organizations.

One of those cited was Victor Baldridge (1971), who used a political model in which interest groups of faculty, students and administrators vied for political power within the organization. In a book entitled Policy Making and Effective Leadership (1978), Baldridge noted that he erred in basing his assumptions on student protest activities of the late sixties and now advocates the bifurcated system of higher education to explain structure and uses the political model to describe process. The Baldridge

model is important because it treats the process of decision making. However, a more adequate approach would incorporate both structure and process in a contingency view of organizational theory.

The seminal work which explains structure in higher education organizations was conducted by Blau (1973) who described a bifurcated organizational structure with characteristics of a bureaucracy in that it has formal division of labor, administrative hierarchy and clerical apparatus. In noting a different organizational structure for faculty, he describes an organization similar to that described by Corson. Blau used the terms "professional authority" and "bureaucratic authority." He noted that the bureaucratic authority takes care of housekeeping and support functions while the academic authority deals with matters pertaining to faculty promotion and tenure and curriculum issues. Blau, although failing to discuss in detail the interaction of the two spheres, contributed significantly to organizational theory.

Prevailing theories, then, seem to account for some aspect of the structure and organization in higher education. None, however, account for the diversity of organizational types found in higher education. Some institutions may represent Millett's academic community model while others seem very close to Weberian bureaucracy. The interplay between the two spheres of Blau's bifurcated system should be incorporated into the development of a phyletic classification scheme.

A Phyletic Classification Scheme for Postsecondary Education

Using the organizational theories and history of higher education, one can begin to understand the nature of the bifurcated system of higher education organizations and the interplay and dominance of one sphere over the other. Since these two spheres are operating in an open system, the environment will affect the nature of the relationship between the two systems. Terreberry (1973) has hypothesized that organizational change is largely externally induced (allogenic theory: see McKelvey, 1982, pp. 77). An analysis of the environment may tell us why a particular structure exists. However, autogenic theories analyze the effects factors internal to the organization have on adaptations in organizational characteristics (McKelvey, 1982, pp. 77).

The present discussion concentrates on identifying a phyletic classification scheme. In the bifurcated structure of colleges and universities there are two spheres of decision making, the bureaucratic sphere and the academic sphere. The bureaucratic sphere evolved from those housekeeping functions and support services for which it takes responsibility. A hierarchy of authority and decision making was set up, divisions of labor were well defined and formalized procedures were developed. In some institutions today, whether because of a strong board or centralization of authority by a strong president, the bureaucratic sphere dominates.

On the other hand, the academic sphere is characterized by minimal definition of divisions of labor and formalized procedures. Authority lies with faculty who in the ideal state as a community make decisions in academic matters. This sphere is like Millett's community of scholars. In those institutions where it dominates, faculty have a great deal of autonomy and departments are the base unit of decision making. This is in contrast to the bureaucratic sphere which is relegated to support services only.

Using dimensions making up the two spheres of the bifurcated system, it is possible to conceptualize a taxonomy of organizations in higher education. Four organizational types seem logical. These are the bureaucratic, the bureaucratic/-academic, the academic/bureaucratic and the academic. Each structural type within the taxonomy can be described and the taxonomy appears as a continuum with dominance of one sphere over the other determining the location on the continuum.

Bureaucratic Institutions

The bureaucratic institutional type is characterized by dominance of the bureaucratic sphere. A hierarchy of decision making exists with most decisions made at the upper levels of administration. Faculty autonomy is minimal and departments, if still existing, have little autonomy. The faculty-administration relationship tends to be adversarial in nature. A vestigial academic sphere exists. Most academic decisions, however, are made at the dean of instruction level or above. These

organizations could best be characterized by formal procedures and policies established at the board level which determine the direction of academic decision making. Some community colleges and some public and private baccalaureate institutions fit into this category.

Bureaucratic/Academic Institutions

The second category in this taxonomy is the bureaucratic/academic institutions. These institutions are characterized by the dominance of the bureaucratic sphere; decision-making procedures are formalized and policies and procedures are written out in detail. The academic sphere exists but is based on institution-wide committees and a faculty senate. Departments have little autonomy. The academic sphere has influence over a narrowly defined area and the administrative hierarchy can supercede those faculty decisions when necessary. Public and private four-year institutions typically characterize this group. Some state colleges and universities which are part of a state system with a history of evolution from normal schools seem to fit as the best examples of this taxonomic type.

Academic/Bureaucratic Institutions

The third category in this taxonomy is academic/bureaucratic. In this institutional type, decision-making processes have experienced some movement out of the department to the central administration, althcugh policies and procedures are not as fully developed as those at the other institutional types. Some procedures are formalized and there is

a demand for uniform data in decision making. Faculty and departmental autonomy are present, but institutional curriculum committees monitor program decisions and degree integrity. Specific procedures for course approval and curriculum change are monitored by institution-wide committees and systems policies. Research is emphasized in some departments and schools within these institutions. The classic examples of this institutional type are regionally prominent universities and land-grant institutions under strong centralized state systems.

Academic Institutions

The final institutional type in this taxonomy is the academic institution where the academic sphere dominates. The bureaucratic sphere is responsible for support services and housekeeping functions. These institutions are characterized by strong faculty and deparmental autonomy. There has been minimal centralization of decision making. These institutions are the closest one can get to the collegial model. Faculty dominance may be a function of faculty reputation nationally and/or a longstanding tradition of a collegial governance structure. Procedures on curriculum, program and promotion are loosely structured and located at the department or school level. The best examples of institutions within this type are prestigious public and private universities and some private colleges.

This phyletic taxonomy is based on the development of the two spheres. Structural dimensions similar to those used by Pugh et al., such as "structuring of activities," "the concentration

of authority" and "control of workflow" can be used to further understand this phyletic taxonomy (1969b, p. 197). The work of Pugh on English Midland's work organizations is a numerical phenotypic taxonomy. In organizational systematics a numerical phenotypic taxonomy will be used to strengthen or negate part or all of the phyletic approach presented above.

THE PHENETIC CLASSIFICATION SCHEME

In contrast to the phyletic approach in organizational systematics with its emphasis on evolution, explanation, and historical development, the broad aim of the phenetic approach is as follows: to identify and describe a classification of organizations according to their "natural" grouping based on observable characteristics and derived from multivariate analysis.

One of the chief benefits of applying the principles of numerical phenetic research is to develop classification methods which are objective, explicit, and repeatable. These standards extend to both the selection and measurement of organizational data, and the analysis and description of relationships resulting from the data (Sneath and Sokal, 1973). A second major benefit is the potential to construct a taxonomy of organizational groups based on a priori theories. Additionally, its comprehensive comparative design permits the exploration and study of large samples of organizations and characteristics, and the discovery of underlying factors of similarity to order the diversity inherent in those samples (Udy, 1965: Sneath and Sikal, 1973).

Finally because it does not presume to explain the origin or evolution of organizational diversity, the phenetic approach can contribute to the construction of a general classification system by refining hypotheses and theory or validating other ordering schema and typologies (Heydebrand, 1973; McKelvey, 1982).

A Review of Numerical Phenetic Literature

The Numerical Phenetic Approach in Organizational Research

The basic criteria for the application of numerical phenetics in organizational research have been noted by various authors (Pugh, et al., 1963; Burns, 1967; Haas and Drabek, 1973; Sneath and Sokal, 1973), and can be summarized under four basic principles. First, the organization is the unit of analysis and is considered a phenomena in its own right. Second, each organizational characterictic chosen for observation is weighed equally or considered of equal importance. Third, the research design attempts to identify and order organizational diversity based on quantitative measures of similarity. Fourth, the major interest is toward generating and describing natural clusters, homogeneous groups or empirical taxa of organizations.

Phenetic Taxonomies in Organizational Theory

Examples of research studies which have utilized numerical phenetics in organizational theory or which have attempted to develop empirically derived classifications or taxonomies of organizations are few. In 1963, Pugh, et al., developed a conceptual scheme for the empirical assessment of organizations which would allow the researcher to construct a taxonomy of

organizations based on the relationships discovered across numerous structural and environmental characteristics. In 1968, they reported their findings as discussed earlier. Since their various publications, several studies have replicated the Pugh methodology to validate their findings, refine the characteristics, or enlarge their sample to other types of organizations. The more important replications are Inkson, et al., 1970; Hining and Lee, 1971; Child, 1972; Reimann, 1973; and Holdaway, et al., 1975.

Also, in the early sixties, Johnson (1963) collected data on 99 characteristics across a sample of 75 organizations to derive one of the first numerical phenetic taxonomies in organizational research. This study as reported in Haas, et al., (1966) isolated the natural classes of organizations which required five taxonomic ranks to fully describe them. Another natural numerical phenetic taxonomy of organizations was reported by Goronzy (1969). In this study, 50 business organizations were grouped by numerical analysis into four natural clusters.

Not only have these studies been cited by other authors as the seminal works in the taxonomic field of organizational theory, but they have also been thoroughly reviewed and critiqued for their phenetic methodology by McKelvey (1975, 1982), and Mansfield (1973).

Phenetic Taxonomies in Higher Education

Cullinan (1964) studied the application of the taxonomic mode of inquiry to education and concluded that it held promise

of meeting the criteria of a discipline; viz., a way of addressing phenomena, an orderly pursuit of new knowledge, the potential for theory construction, and a useful guide in the development of systematic classification. However, a review of the literature produced only three research studies in higher education which might be considered numerical phenetics.

Astin (1962) was one of the first to use empirical methods to differentiate colleges and universities based on the factor analysis of multiple characteristics. Holdaway, et al., (1975) replicated the Pugh methodology and examined structural and contextual characteristics of 23 higher education institutions in Canada. Using multiple correlations and factor analysis, the study derived three factors for describing organizational diversity: bureaucratic control, administrative configuration, and nonworkflow personnel. Anderson (1977) reported results of a numerical taxonomy of private liberal arts colleges using cluster analysis on twelve financial indicators.

What remain in the literature as a basis for a systematic approach to classify colleges and universities are various governance typologies which have been suggested for the study of academic organizations discussed previously. Also, there are the two most commonly referred to classification schemes of the National Center of Educational Statistics and the Carnegie Commission. Although these schema and classifications systems are adequate for the purposes for which they are intended, they are limited to those purposes and as suggested earlier, do not

serve the requirements of organizational theory or organizational systematics. A numerical phenetic approach to organizational classification would provide the basis for identification, description, and scientific understanding of organizational diversity.

A Phenetic Classification Scheme for Postsecondary Education Based on Organizational Structure

The present research, a numerical taxonomy (Bartkovich, 1982), used a multivariate approach to examine how institutions of higher education empirically clustered into groups on four underlying dimensions or organizational structures. These underlying dimensions or phenotypic factors were obtained from a principle component analysis of nine characteristics reflecting Weberian and sociological definitions of formal structure (i.e., positions, functions, and procedures). Factor scores for each institution in the sample on each of the underlying phenotypic factors were calculated and used to derive a classification of 16 organizational taxa. Additionally, 23 other characteristics were used for descriptive and explanatory purposes.

Methodology

For the objectives of the study, nine characteristics of organizational structure were drawn from the literature and operationalized for the higher education setting. These characteristics were institutional autonomy, centralization of decision making, functional specialization, effective

participation, formalization of procedures, and four measures of organizational configuration, including hierarchy of control, division of labor, vertical span, and presidential span. A second set of characteristics consisted of 23 institutional attributes which are commonly used to describe the diversity of organizations in higher education, including such items as age, control, faculty and student size, financial indices, federal aid, etc. Definitions of these structural and descriptive characteristics are provided in Appendix I.

Data were collected for the structural characteristics from a survey sent to the presidents of the sample institutions (Appendix II). The instrument was modeled after the work of Pugh and modified to represent structural indices mentioned in the literature on organizational theory and higher education. It was field tested on a sample of fifty institutions in Virginia. Data for the descriptive characteristics were collected from the 1978-79 HEGIS XV survey and other secondary sources. In addition to completing the survey, the presidents were asked to send a detailed organizational chart for measuring the hierarchical and administrative configuations of the institution's structure. Two follow-up procedures were performed to insure the opportunity for response.

The population for the study consisted of 2,508 colleges and universities categorized in the Carnegie Classification as being either doctoral-granting, comprehensive, liberal arts, or two year. A stratified random sample of 200 institutions was drawn

in approximate proportion to the percentages of the four types in the population, i.e., 20 doctoral (10%), 50 comprehensive (25%), 50 liberal arts (25%), and 80 two-year (40%). At the completion of the formal data-gathering period, 150 usable responses and organizational charts were received for a response rate of 75%. Analysis of the representativeness of the sample showed no significant difference between the population-sample or the response-nonresponse rates.

Data Analysis

As required by the research design, data analysis proceeded in the following manner. First, a correlation matrix was constructed to explore the basic relationships among the structural characteristics. Given this array of correlation coefficients, factor-analytic techniques were employed to discover the underlying pattern of relationships which existed, with the intent of reducing the number of organization characteristics to a smaller set of phenotypic factors. A four-factor solution was achieved and perceived as defining a four-dimensional phenotypic space in which organizational diversity in higher education could be ordered and described. The development of the taxonomy proceeded by partitioning the four-dimensional space into taxonomic clusters derived from dichotomized organizations' factor scores on the phenotypic factors. Consequently, 16 taxonomic clusters were identified as representing optimally homogeneous groups of institutions.

Conceptual Analysis of the Structural Correlations

Pearson product-moment correlations among the structural characteristics were calculated to obtain a basic idea of the interrelationships in the data prior to their factor analysis, and to provide guidance in further evaluation and interpretation. This matrix is provided in Table 1, and a general conceptual review is presented below.

In the analysis of the correlation matrix, two distinct groups of structural characteristics became evident. One group was composed of the characteristics autonomy, functional specialization, and vertical span (each of which correlated signifcantly and positively with the other two), and division of labor which correlated with vertical span. The second group was composed of the characteristics centralization, formalization, participation (each of which correlated significantly and positively with the other two), and hierarchical control which correlated with centralization. The separation of these two groups was further evidenced by the significant negative correlation of autonomy with centralization, participation, and hierarchical control, and the significant negative correlation between functional specialization and hierarchical control.

These groups seemed to be influenced in the composition by the strong inverse correlation between autonomy and centralization (-.68). This correlational clustering of the structural characteristics suggests that at a very general level of interpretation, a classification continuum of organizations in

higher education based on structural correlations may be evident between two extreme types of organizations. The first type was dominated by the autonomy characteristic and showed correlations traditionally associated with the collegial view of academic organization, i.e., decentralized decision making, less formalized responsibilities and authority within the hierarchy, and more institutional autonomy. The second type was dominated by the centralization characteristic and showed correlations traditionally associated with the bureaucratic view of academic organizations, i.e., formalized and standardized procedures and personnel policies, power and authority residing in the hierarchy, less institutional autonomy, and participation by more groups in the decision-making process, but not necessarily in the actual decision.

Phenotypic Factor Analysis

The nine structural characteristics were factor analyzed by the principle component method with varimax rotation. Factors were retained for rotation if their eigen value was greater than or equal to 1. This approach provided for the reduction in the number of structural characteristics to more theoretical phenotypic factors which could be used to describe organizational structure in higher education and serve as a basis upon which a numerical phenetic taxonomy could be developed.

The principle component method extracted four underlying factors which together accounted for 68.1% of the total variance. Table 2 provides the loadings of the nine structural

characteristics on the four factors, both before and after rotation. A conceptual analysis of these four phenotypic factors are provided below.

Phenotypic Factor I: Decision-making Authority. The first factor loaded most heavily on the characteristics authority (-.85) and centralization (.86). These characteristics were both concerned with the allocation of authority to make decisions. Autonomy involved whether decison making was within or outside of the boundaries of the institution, while centralization is concerned with the location of decision making within the organizational structure of the institution. The first underlying phenotypic factor was referred to as decision-making authority.

This bi-polar factor contrasted organizations which were highly centralized in their decision-making process and more tightly controlled by outside agencies with those which were highly decentralized and more autonomous. Consequently, in the later development of the taxonomy, this factor had a tendency to divide institutions into distinctive types along a single continuum. Those institutions which scored high on this factor were a type which tended to concentrate decision-making authority at the central administrative levels and be less self-governing. Those institutions which scored low on this factor were a type which tended to decentralize decision-making authority to the lower levels of the administrative hierarchy and be more autonomous.

Phenotypic Factor II: Functional Differentiation. The second factor loaded most heavily on the characteristics functional specialization (.63) and vertical span (.73). Because these characteristics were both concerned with the distribution of functional responsibility, either to full-time personnel or down the administrative hierarchy, the second underlying phenotypic factor was referred to as functional differentiation.

In the later development of the taxonomy, this factor had a tendency to group institutions based on their diversification of functional responsbility within and down the organizational hierarchy. Those institutions which scored high on this factor were of a type which displayed an organizational structure which was more highly differentiated by tasks and administrative levels than those institutions which scored low. This factor correlates significantly and positively with the size and enrollment of an institution.

Phenotypic Factor III: Administrative Configuration. The third factor loaded most heavily on the characteristics hierarchical control (.50), division of labor (.65), and presidential span (-.59). Because all of these measures were obtained from the organizational charts and all were concerned with the shape of the chart as an indication of the distribution of power and authority within the organization, this phenotypic factor was referred to as administrative configuration.

As the first two issues loaded positively and the third issue negatively, there was some support for a bi-polar

interpretation of this factor. Consequently, in the later development of the phenetic taxonomy, the contribution of this factor for classifying organizations was a function of the administrative hierarchy as formalized and depicted in the organizational chart. Those institutions which scored high on this factor were of a type which charted a formal organizational structure which tended to be "tall and slim" and with position authority and reporting channels evenly dispersed among the hierarchical levels. Those institutions which scored low on this factor were of a type which had a tendency to be "short and broad" and with a wide presidential span.

Phenotypic Factor IV: Operational Procedures. The fourth factor was most heavily loaded on the characteristics of formalization (.78) and participation (.56). Because these characteristics were both concerned with procedural matters, either in the extent to which policy, personnel, and standard operating procedures were formalized in written documents, or in the extent to which personnel were procedurally incorporated into the decision-making process, the fourth phenotypic factor was referred to a operational procedures.

In relation to this factor, institutions may be classified according to their formalized procedures for administering the organization and for allowing for effective participation and consultation by the various levels or professional groups in the decision-making process. Those institutions which scored high on this factor tended to have more standardized procedures and

policies for the operations of the institution and tended to provide greater opportunity for more individuals to provide input into the decision-making process. Those institutions which scored low on this factor tended to be less formal and standardized in their operations and also less participatory in the decision-making process. That is, in each decision, there is a tendency for one person to be making the decision without input from a number of other individuals.

Derivation of the Phenetic Taxonomy

The importance of the four phenotypic factors was that they formed the empirical and descriptive foundation upon which the phenetic taxonomy was based. To derive this taxonomy, factor scoring coefficients from the principle component analysis were used to generate factor scores for each institution on each of the four phenotypic factors. Each score represented the institution's placement on one factor, and in combination provided for the unique classification of the institution across the four factors.

To assist in identifying the grouping of institutions across the factors, the factor scores were dichotomized at the mean and each institutional score revalued as being either high or low. Because factor scores are standardized with the mean of 0, this dichotomization resulted in an institution being classified as scoring high on the phenetic factor if its score was positive ard as scoring low if its score was negative. The dichotonomization of scores consequently produced 16 mutually exclusive groups or

clusters of institutions. The 16 unique clusters accounted for all possible combinations of the high-low scores on the phenotypic factors, and each institution was uniquely assigned to one of the 16 clusters. As each cluster contained more than one institution, it appeared that the 16 clusters adequately represented the organizations inherent in the study, and that the four phenotypic factors adequately described the structural diversity measured in the sample.

A graphic representation of the derivation of the clusters in the traditional form of a hierarchical tree is provided in Figure 2. Here the successive division of the sample into 16 clusters is more evident. In this discussion, the order of presentation of the phenotypic factors has been based on their decreasing percentage of explained variance as derived from the principle component analysis. The inherent strength of this method of presentation is that it reflects the empirical groupings of the institution void of any a priori assumptions. However, because the phenotypic factors are orthogonal, the 16 clusters remain independent groups.

In association with the phyletic classification scheme previously discussed, the taxonomy would provide a conceptual hierarchy or theoretical ordering of the institutional diversity represented by the 16 clusters. This is the purpose of the next section, to use the phyletic scheme to order the clusters conceptually, and to use the phenetic taxonomy to define and

describe the types, groups, and subgroups of organizations so classified.

TOWARD A GENERAL CLASSIFICATION SYSTEM: A COMBINED PHYLETIC-PHENETIC APPROACH

The principle strength of the phyletic approach in organizational classification is that it attempts to explain the origin and evolution of naturally occurring groups. The principle strength of the phenetic approach is that it attempts to identify naturally occurring groups that emerge from observation and measurement. The phyletic approach is inductive and has traditionally rested on a priori theories, and the phenetic approach is deductive and has traditionally rested on empiricism and multivate analysis. Each approach has its strong defenders and equally strong critics.

In Organizational Systematics, McKelvey suggests that a combined phyletic-phenetic approach using the strengths of each to counter the weakness of the other may best serve the needs and requirements of organizational science (p. 59). He notes that numerical phenetics can be enhanced and the stability of the derived taxonomy increased by capitalizing on the intuitive ordering of the phenomena provided by a phyletic classification. Likewise, evolutionary phyletics can be strengthened and the validity of the classification scheme increased by relying on the objective analysis and empirical procedures of the numerical phenetist. Such an approach, combining the methods and results of the two classification schemes previously developed, is

proposed below. In its presentation, the general classification system for organizations of higher education will use the 16 empirically derived taxonomic clusters to substantiate the 4 organization types proposed in the phyletic scheme, and use the 4 organizational types to hierarchically group the taxnomic clusters by conceptually ordering the phenotypic factors from which they were derived.

Two of the strong historical trends which shaped the development of the phyletic scheme were decision-making authority and functional responsibility for the operations of the institutions. Two components described in the phyletic approach, an academic and a bureaucratic sphere evolved. Historically, as each component developed, they performed clearly differentiated functions; but equally important, they were separated by the different backgrounds, values and skills of the individuals employed in each (Duryea, 1973).

The evolutionary problem became one of designing institutions with appropriate decision-making procedures and functional procedures that would enable each component to pursue its particular concerns as efficiently and harmoniously as possible in areas or concerns which overlapped with those of the other component. The phyletic classification scheme was developed, in part, to describe these two components, either in their ideal type, in their opposition, or in their integration of decision-making authority and functional resonsibility.

A similar interpretation of the substantive effect of the decision making and functional responsibility defining an organizational structure is evident in the phenetic classification scheme when phenotypic Factor I is analyzed in conjunction with Factor IV. Factor I, termed Decision-making Authority, concerned the allocation of authority to make decisions as measured by two characteristics, autonomy and centralization. Factor IV, termed Operational Procedures, concerned procedural matters, either in the extent to which policy, personnel matters and operating functions were formalized, or in the extent to which personnel were procedurally incorporated into the decision-making process (effective participation). Factors I and IV together accounted for 35.3% of the total variance found in the original structural characteristics and over 50% of the variance explained by the four phenotypic factors.

With further support provided by the intercorrelations found in the analysis of the structural characteristics, hidden in the relationship of Factors I and IV is evidence of the exchange between the traditions of academic governance through faculty participation and institutional autonomy and the equally strong bureaucratic tendencies in academic administration for centralized control for efficient operations of complex organization. At issue is first recognition of the normative types of organizations of higher education proposed in the bureaucratic and academic spheres of the phyletic scheme, and

second utilization of a conceptually sound theory to analyze the factors to order the taxonomic clusters of the phenetic scheme.

The convergence of the two schemes is evident in the following descriptions. First, given the definition of the bureaucratic type proposed in the phyletic scheme, institutions which scored high on the first and fourth factors in the phenetic scheme also can be described as centralized and bureaucratic in decision-making authority and formalized in procedures. Additionally, they are also more participatory in that they allow for more levels of authority to provide input in the decision-making process on individual decisions. Second, given the definition of the academic type proposed in the phyletic scheme, institutions which scored low on the first and fourth factors in the phenetic scheme also can be described as highly autonomous and more democratic in the delegation of authority and less formalized in functional procedures and established policy. Additionally, they are less participatory in their decision-making process on individual issues because decisions are made at lower levels in organization requiring less input from others. Finally, those institutions classified as the bureaucratic-academic type in the phyletic scheme correspond to those institutions scoring high on the first factor and low on the fourth factor in the phenetic scheme. Those institutions classified as the academic-bureaucratic type in the phyletic scheme correspond to those institutions scoring low on the first factor and high on the fourth factor.

Factors I and III further subdivide each of the four type of institutions. That is, once an institution is classified into its appropriate type, it can be further described by either its high score on Factor II suggesting an organizational structure which is highly differentiated by tasks and administrative levels or by its low score on Factor II suggesting an organizational structure which is not differentiated but agglomerative. Phenotypic Factor III, termed Administrative Configuration and concerned with the shape of the organization chart as an indication of the distribution of power and authority within the organization, further divides each of the eight groups into two subgroups. That is, once an institution is classified into its appropriate type and then group, it can be further described by either its high score on Factor III suggesting a "tall and slim" hierarchy or its low score on Factor III suggesting a "broad and short" hierarchical arrangement.

The 16 subgroups represent the 16 taxonomic clusters derived in the phenetic scheme, but they have been rearranged by ordering the presentation of the phenotypic factors based on the evolutionary-historical theory and conceptual types derived in the phyletic scheme. It is suggested that not only does this combined classification system make inductive sense, but is deductively sound as well. A brief description of this general classification system using the descriptive characteristics of the numerical taxonomy study will concentrate on the four phyletic-phenetic types.

Bureaucratic Institutions

Institutions in this type scored high on Factors I and IV defining them as being centralized in their decision-making authority, formalized in their procedures and participation in the decision-making process on individual issues. A visual analysis of institutional attributes showed the following tendencies: to be younger, to be public, to have a high student to faculty ratio, to have lower total expenditures and endowments, to have a larger portion of their budget expended for administrative and institution support, and to have very high reliance on federal, state and local support. Forty-three institutions were classified as this type, of which 3 were doctoral-granting, 11 comprehensive, 6 liberal arts, and 23 two-year; 31 were publically controlled and 12 were private.

Bureaucratic/Academic Institutions

Institutions in this type scored high on Factor I and low on Factor IV, defining them as being centralized in their decision-making authority, informal in their functional procedures and less participatory in their decision-making process. A visual analysis of institutional attributes data showed the following tendencies: to be public, to have the higher total revenues and expenditures, to have high expenditures per student, to have high support for research and academics, to have less reliance on tuition/fees and federal and state support, and to have a high reliance on state support. Twenty-two institutions were classified to this type, of which 5 were doctoral-granting, 9

comprehensive, 1 liberal arts, and 7 two-year; 17 were public and 5 were private.

Academic/Bureaucratic Institutions

Institutions in this type scored low on Factor I and high on Factor IV, defining them as being autonomous in decision-making authority, formalized in their procedures and participatory in their decision-making process. Visual analysis of institutional attributes showed the following tendencies: to have a high student to faculty ratio, to have lower total expenditures and revenues, to have less expenditures per student, to have low research expenditures, to have high expenditures for administration and institutional operations, to have heavy reliance on tuition/fees and local support, and low federal aid. Thirty-nine institutions were classified to this type, of which 3 were doctoral-granting, 13 were comprehensive, 12 were liberal arts, and 11 were two years; 18 were public and 21 were private.

Academic Institutions

Institutions in this type scored low on Factors I and IV, defining them as being autonomous in decision-making authority, informal in operations and procedures, and less participatory in their decision-making process. Visual analysis of institutional attributes showed the following tendencies: to be older and private, to have high endowments and building assets, to have lower expenditures for academic support, high reliance on tuition/fees for operating revenues, and low reliance on state and local support. Forty-five institutions were classified as

this type, of which 8 were doctoral-granting, 13 were comprehensive, 17 were liberal arts, and 8 were two-year; 11 were public and 35 were private.

Future research is needed to identify statistically significant demographic characteristics for each group and to further analyze the importance of Factors II and III.

SUMMARY

This paper uses Organizational Systematics, namely a phyletic-phenetic approach to develop a taxonomy of organizational types in higher education. A phyletic approach based on decision-making authority and functional responsibilities developed a classification scheme, composed of four institutional types: Bureaucratic, Bureaucratic/Academic, Academic/Bureaucratic, and Academic.

A numerical phenetic analysis identified four factors: Decision-making Authority, Functional Differentiation, Administrative Configuration, and Operational Procedures. By reordering these factors based on the phyletic scheme and the significance of Factor I, the phenetic taxonomy substantiates and reinforces the phyletic taxonomy. Further research is needed to refine and substantiate this classification scheme.

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Figure 1

A Classification Scheme

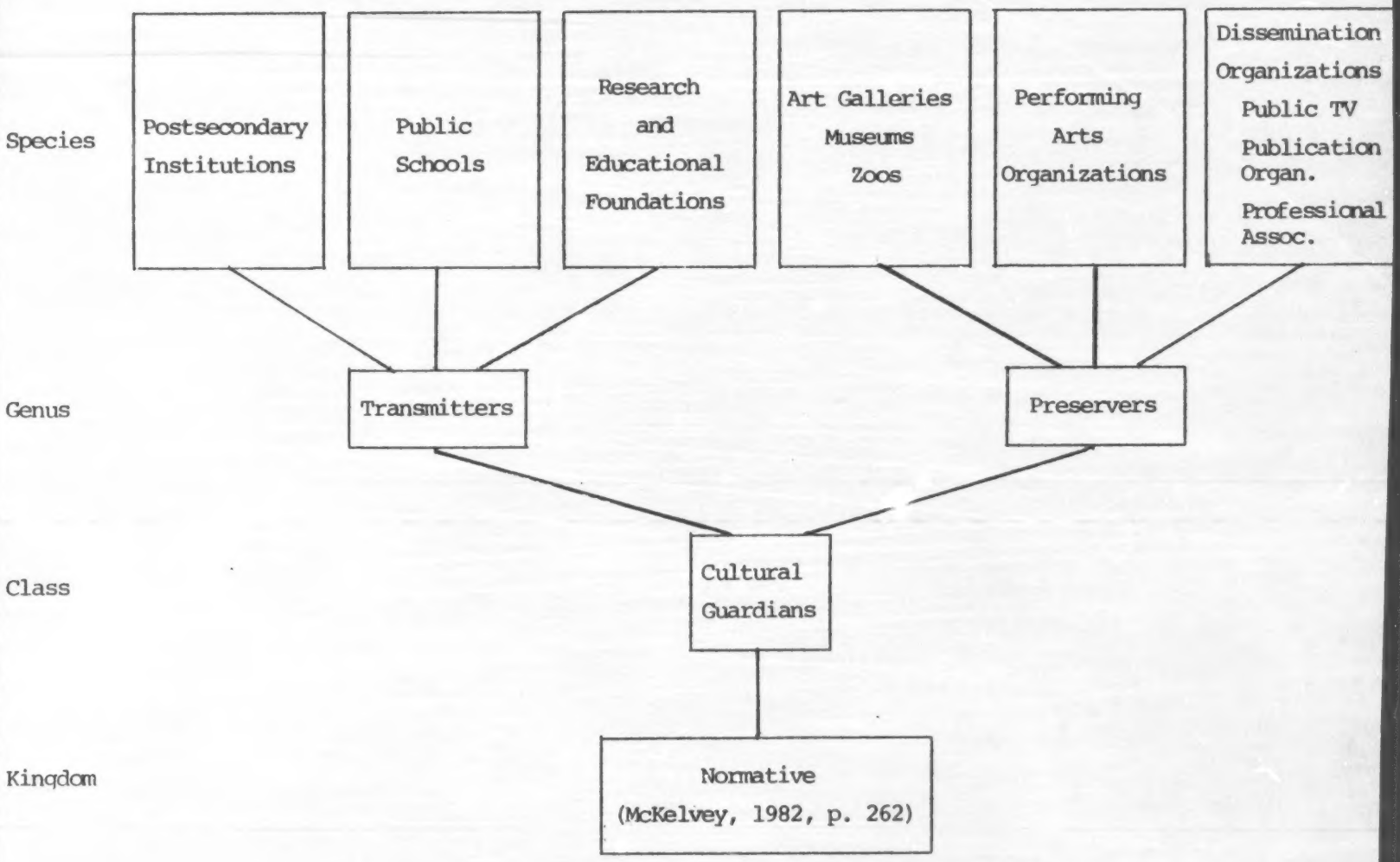

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Table 1

Correlation Matrix for the Structural Dimensions

	Autonomy	Centralization	Functional Specialization	Vertical Span	Participation	Formalization	Hierarchy	Division of Labor	Presidential Span
Autonomy	1.0								
Centralization	-.68[A]	1.0							
Functional Specialization	.24[A]	-.08	1.0						
Vertical Span	.18[A]	-.04	.50[A]	1.0					
Participation	-.23[A]	.25[A]	.07	.15	1.0				
Formalization	-.20	.22[A]	-.04	-.09	.25[A]	1.0			
Hierarchy	-.27[A]	.22[A]	-.26[A]	-.04	.03	-.01	1.0		
Division of Labor	-.01	.02	.04	.24[A]	.05	.01	.12	1.0	
Presidential Span	.04	.00	.15	.00	-.07	-.13	-.10	-.13	1.0
Presidential Span[1]	.15	-.11	.32[A]	.11	-.16	-.08	-.55[A]	-.01	1.0

[A] Significant at alpha = .05

[1] Spearman coefficient

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Table 2

Principal Component Analysis of the Structural Dimensions

	Factor I: Decision-Making Authority		Factor II: Functional Differentiation		Factor III: Administrative Configuration		Factor IV: Operational Procedures	
Autonomy	-.85*	(-.83)+	.19	(-.12)	-.03	(.13)	-.15	(-.23)
Centralization	.86	(.76)	-.01	(.27)	-.01	(-.21)	.17	(.26)
Functional Specialization	-.14	(-.49)	.82	(.63)	-.16	(-.26)	.03	(.12)
Vertical Span	-.07	(-.38)	.81	(.73)	.30	(.17)	-.03	(.19)
Participation	.35	(.34)	.31	(.58)	.04	(-.18)	.56	(-.23)
Formalization	.15	(.41)	-.08	(.26)	-.06	(-.21)	.78	(-.61)
Hierarchical Control	.44	(.47)	-.25	(-.07)	.53	(.50)	-.26	(.37)
Division of Labor	.03	(.01)	.26	(.40)	.73	(.65)	-.04	(.10)
Presidential Span	-.22	(-.19)	.26	(-.07)	-.60	(-.59)	-.49	(.59)
% of Total Variance	20.9		18.6		14.3		14.4	

*Loadings for rotated factor matrix +Loadings for original factor matrix

Table 3

Number of Institutions Classified

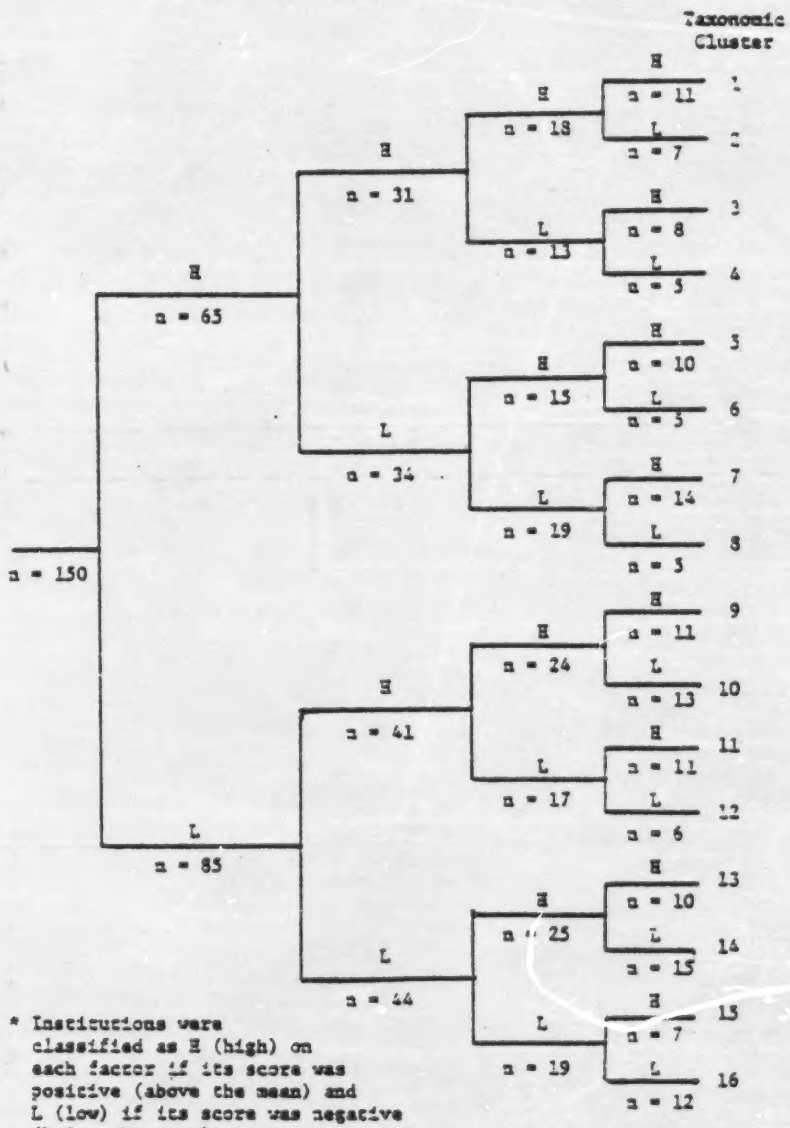
by Phyletic-Phenetic Type and

Carnegie Type

	Bureaucratic	Bureaucratic/ Academic	Academic Bureaucratic	Academic	
Doctoral Granting	3	5	3	8	19
Comprehensive	11	9	13	13	46
Liberal Arts	6	1	12	17	36
Two-year	23	7	11	8	49
	43	22	39	46	150

Figure 2

The Taxonomic Hierarchy and Number of Institutions Classified at Each Level



* Institutions were classified as H (high) on each factor if its score was positive (above the mean) and L (low) if its score was negative (below the mean).

n = the number of institutions classified at that level

APPENDIX I

STRUCTURAL CHARACTERISTICS

1. Institutional autonomy measured the extent of decision-making authority which resided within the organization as opposed to its being outside the organization.

2. Centralization of authority measured the level at which executive action was authorized within the decision-making process.

3. Functional specialization measured the allocation of tasks and responsibilities to individuals within the organization.

4. Formalization of procedures measured the extent to which rules, regulations, operational procedures, and role-defining documents were standardized.

5. Effective participation measured the relative inclusion of various levels of authority within the organization in the decision-making process.

6. Hierarchy of control measured the degree of cumulative authority and responsibility resting in the various levels of the hierarchy.

7. Division of labor measured the relative distribution of personnel among the various employment levels in the organization.

8. Vertical span measured the number of levels in the hierarchy.

9. Presidential span measured the number of positions which reported directly to the chief executive office.

DESCRIPTIVE CHARACTERISTICS

10. Age

11. Control - Either public, affiliated with a religious denomination, or private and non-sectarian

12. Location - Affiliation with a regional accrediting agency

13. Size 1 - Full-time faculty

14. Size 2 - Full-time students

15. Student-Faculty Ratio

16. Average Faculty Salary

17. Complexity - Number of academic disciplines in which degrees were conferred

18. Percentage of full-time, out-of-state students
19. Total revenues
20. Tuition and fees as a percentage of total revenues
21. Federal support as a percentage of total revenues
22. State support as a percentage of total revenues
23. Local support as a percentage of total revenues
24. Total educational and general expenditures
25. Instructional as a percentage of total expenditures
26. Research as a percentage of total expenditures
27. Academic support as a percentage of total expenditures
28. Institutional support as a percentage of total expenditures
29. Expenditures per students
30. Endowment
31. Building and physical plant assets
32. Federal aid obligated by the Department of Education

UNIVERSITY OF VIRGINIA
CENTER FOR THE STUDY OF HIGHER EDUCATION

National Survey on Organizational Structure in Higher Education

Part I: Please put a check next to those functions listed below which at your institution have *at least* one person with full-time responsibility for administering that function.

( ) Public Relations
( ) Alumni Relations
( ) Market Research
( ) Institutional Research
( ) Government Liaison

( ) Legal and Insurance Requirements
( ) Faculty Development
( ) Inventory Control
( ) Budget Review and Analysis
( ) Hiring of Personnel

( ) Developing New Programs/Courses
( ) Obtaining Research Grants
( ) Foundation or Endowment Management
( ) Recruitment of High School Students
( ) Administering a Discipline

( ) Administering a Division
( ) Off-Campus Instruction (Credit)
( ) Continuing Education (Non-Credit)
( ) Student Placement and Career Planning
( ) Administering Entrance Examinations

( ) Administrative Assistance to the President
( ) Administrative Assistance to a Dean
( ) Resident Housing
( ) Affirmative Action
( ) Productivity Analysis

Part II: For each decision below, please put the number of the *one level* which has the authority to make the decision. Authority means that executive action can be taken on the decision even though the decision may be subject to review and final approval later.

Also, please put the numbers of the *levels* which significantly participate in the decision-making process. Participation may include consulting or providing input into the selection of alternatives considered.

Levels of Authority and Participation
1 = Individual Faculty
2 = Department/Division Faculty
3 = College/University Faculty
4 = Department/Division Chairperson
5 = College Dean or Provost
6 = President or Administrative Staff
7 = Governing Board
8 = Systems Office or State Agency

Example:

Decisions	Level of Authority	Level of Participation
To offer a new program of study	8	2. 3. 5
Promotion/tenure of faculty	5	3. 6

* * * * * * * * * * *

Decisions	Level of Authority	Level of Participation
Merit Raises for Faculty		
Promotion/Tenure of Faculty		
Faculty Salaries		
Selection of Faculty		
Termination of Faculty		
Promotion of Administrators		
Administrative Salaries		
Selection of Deans		
Selection of Department Heads		
New Administrative Positions		
Granting Faculty Leaves/Sabbaticals		
Modifying Degree Requirements		
Grading Standards for Class Performance		
Teaching Loads		
Student Retention Policies		
Tuition Costs and Fees		
To Amend the Mission		
Size of the Student Body		
Graduation Standards		
Standards of Admission		

Decisions	Level of Authority	Level of Participation
Revising Course Requirements or Content	_____	_____
Scheduling of Class Offerings	_____	_____
Assignment of Faculty to Off-Campus Sites	_____	_____
Offer a New Course with Existing Course Number	_____	_____
Offer a New Course Requiring a New Course Number	_____	_____
Goals of Long-Range College Plans	_____	_____
Allocating Funds to the College	_____	_____
Allocating Funds to the Department	_____	_____
Allocating Funds within the Department	_____	_____
Capital Outlay Priorities	_____	_____

Part III: Please indicate by checking "yes" or "no" if the following procedure or document exists at your institution.

		Yes	No
1.	Written record of maintenance work done	( )	( )
2.	Request forms to spend over $100	( )	( )
3.	Request forms to hire an instructor	( )	( )
4.	Approval of research grants prior to submitting budget	( )	( )
5.	Standardized requirements and job descriptions for:		
	a. Administrative personnel	( )	( )
	b. Instructional personnel	( )	( )
	c. Classified personnel	( )	( )
	d. Chief executive	( )	( )
6.	Written contracts of employment for:		
	a. Administrative personnel	( )	( )
	b. Instructional personnel	( )	( )
	c. Classified personnel	( )	( )
	d. Chief executive	( )	( )
7.	Written course outlines available for faculty	( )	( )
8.	If yes to #7, are they:		
	a. mandatory	( )	( )
	b. on file at the dean level	( )	( )
	c. on file at the division level	( )	( )
	d. on file at the department level	( )	( )

		Yes	No
9.	Faculty handbook	( )	( )
10.	Policy manual	( )	( )
11.	A written organizational chart	( )	( )

Name and title of person completing this survey *if other than the president:*

_____

Please do not forget to attach a copy of your organizational chart. Thank you.